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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/003,113	12/06/2001	Shunichi Sekiguchi	216934US2	5214

22850 7590 01/02/2008

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EXAMINER	
HUNG, YUBIN	
ART UNIT	**PAPER NUMBER**
2624	

NOTIFICATION DATE	DELIVERY MODE
01/02/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/003,113	Applicant(s) SEKIGUCHI ET AL.	
	Examiner Yubin Hung	Art Unit 2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 October 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *28-30* is/are allowed.

6)☒ Claim(s) *1-4,8,9,12,13,15-17,20-22 and 24* is/are rejected.

7)☒ Claim(s) *5-7,10,11,14,18,19,23 and 25-27* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *06 December 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed 10/30/07 has been entered.

Response to Amendment/Arguments

2. Claim 30 has been added; currently claims 1-30 are still pending.

3. In view of Applicant's amendment, the 35 USC 112 rejection of claims 10, 11, 18 and 19 has been withdrawn.

4. Applicant's arguments filed 10/30/07 have been fully considered but they are not persuasive. Specifically, applicant recites elements involving edge unsharpened image of claim 1 (and similarly claims 8 and 16) and what Fu discloses and asserts that Fu does not disclose those element and then asserts that Mitra does not make up for deficiencies of Fu (P. 16, last paragraph through P. 17, last paragraph).

4.1 However, the examiner stands by the rejection of claim 1 (and similarly claims 8 and 16) because Mitra discloses edge-smoothing (i.e., edge-unsharpening) prior to encoding using DCT (as applicant agrees to on P. 17, 2nd paragraph, lines 1-3) and also because to perform edge smoothing it necessarily needs to use edge information; therefore Mira offers necessary teachings to cure the deficiencies of Fu (namely the obtained density information that is subsequently coded and decoded is not necessarily that of an edge unsharpedned image), as the examiner recited in the analysis and rejection of claims 1, 8 and 16 in Office action mailed 09/20/07.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1, 8 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fu et al. (US 5,703,965), in view of Mitra et al. (US 5,426,673).

7. Regarding claim 1, Fu discloses

- extracting edge information which is binary information representing an edge part of said original image
  [Fig. 5, ref. 302 and Col. 14, lines 8-9 (edge file). Note that the edge file contains binary edge information indicating whether a pixel is or is not a pixel, along with their color values. See also Fig. 3 and Col. 18, lines 48-52 (binary edge information)]
- obtaining coded edge information by coding said edge information according to a first coding algorithm
  [Fig. 5, ref. 304 and Col. 14, lines 19-22. Note that the binary edge information is encoded along with other information]
- obtaining coded density information by coding said density information of *said image* according to q second coding algorithm
  [Fig. 5, ref. 312 (same as Fig. 3, ref. 312) and Col. 8, lines 53-58. Note that Fu does not expressly disclose that *said image* is edge unsharpened image; this is taught by Mitra, see below]
- sending said coded edge information and said coded density information as said coded information to said image decoding apparatus
  [Fig. 5, refs. 306 & 314]
- obtaining said edge information by decoding said coded edge information according to a first decoding algorithm corresponding to said first coding algorithm
  [Fig. 5, ref. 402 and Col. 14, lines 30-32]
- obtaining said density information of *said image* by decoding said coded density information according to second decoding algorithm corresponding said second coding algorithm
  [Fig. 5, ref. 316 (same as Fig. 3, ref. 316) and Col. 8, line 63-Col. 9, line 3]
- obtaining said reproduced image from said density information of *said image* by restoring said edge part of *said image* by using said edge information
  [Fig. 5, ref. 500 and Col. 14, lines 32-35; see also Fig. 12 for detailed sharpening operation. Note that the edge part is restored by sharpening (using the edge information) and the edge-restored image is the reproduced image]

- wherein said second coding algorithm and said second decoding algorithm are based on a standard coding method using a discrete cosine transform
[Fig. 5, refs. 312 & 316 (same as Fig. 3, refs. 312 & 316); Col. 8, lines 53-58 and Col. 8, line 63-Col. 9, line 3. Note that JPEG is based on DCT]

Fu does not expressly disclose the that *said image* is an edge unsharpened image nor the following, but Mitra does

- obtaining density information of an edge unsharpened image from said original image by unsharpening said edge part
[Col. 1, lines 45-48. Note that the image is edge-smoothed (i.e., edge-unsharpened) before encoding]

Fu and Mitra are combinable because they both have aspects that are from the same field of endeavor of compression.

At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify Fu with the teachings of Mitra by edge-unsharpening an image before encoding. The motivation would have been to reduce the size of the compressed image data because the smoothed part will have less variation, which typically results in better compression because compression schemes take advantage of redundancy in data and less variation means more redundancy.

Therefore, it would have been obvious to combine Mitra with Fu to obtain the invention as specified in claim 1.

8. Regarding claim 8, note that the combined invention of Fu and Mitra further discloses the recited coding apparatus [Fu: Fig. 1, 102 (Source System); Fig. 2 (hardware platform for either the source system or the destination system); Fig. 5, "Source System;" Col. 6, lines 16-20 & 39-65. Note that Fig. 5 shows the edge extracting part (302), the first coding part (304) and the second coding part (312), all implemented in software and it would have been obvious to also implement the edge unsharpening operation taught by Mitra in software as a part of the apparatus since the CPU is the only device in the apparatus of Fig. 2 capable of carrying out such operation and adding another piece of computing device (for unsharpening) will increase cost. Note further that the combined invention of Fu and Mitra discloses all functions performed by the parts recited in claim 8, per the analysis of claim 1].

9. Regarding claim 16, note that the combined invention of Fu and Mitra further discloses the recited a decoding apparatus [Fu: Fig. 1, 106 (Destination System); Fig. 2; Fig. 5, "Destination System;" Col. 6, lines 16-20 & 39-65. Note that Fig. 5 shows the first decoding part (402), the second decoding part (316) and the edge restoring part (500), all implemented in software. Note further that the combined invention of Fu and Mitra discloses all functions performed by the parts recited in claim 16, per the analysis of claim 1].

*****

10. Claims 2-4, 12, 13, 15, 20-22 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fu et al. (US 5,703,965) and Mitra et al. (US 5,426,673) as applied to claims 1, 8 and 16 above, and further in view of Vlahos et al. (US 6,363,526).

11. Regarding claim 2, the combined invention of Fu and Mitra discloses all limitations of its parent, claim 1.

The combined invention of Fu and Mitra does not expressly disclose the following, but Vlahos does

- performing first matrix operation by using a first block density information vector and unsharpening matrix, wherein said first block density information vector is obtained by arranging density information of each pixel included in a first block, said first block includes a pixel in said edge part or in a near region of said edge part and includes pixels in a surrounding region around said pixel, and order of said first block density information vector corresponds to the number of pixels in said first block, and wherein said unsharpening matrix includes coefficients used for edge unsharpening which operate on density information of each pixel in said first block
[7, ref. 5; Col. 3, lines 49-56; Col. 6, lines 13-15. Note that the first block is either a 1x3 or a 3x1 pixel block (considered as a 3rd order vector, per P. 25, lines 20-27 of the instance application) and the coefficients of the corresponding unsharpening matrix have values of α (=0.5) at the center and $(1-\alpha)/2$ (=0.25) at each of the other two locations]
- obtaining unsharpened density information of each pixel by overlaying density information of each pixel in said first block obtained by performing said first matrix operation on each pixel while scanning said original image pixel by pixel
[Col. 3, lines 49-56. Note that the weighted average reflects the overlaying. Note further that per Col. 5, lines 6-30 the image is scanned pixel by pixel]

The combined invention of Fu and Mitra is combinable with Vlahos because they both have aspects that are from the same field of invention of image enhancement.

At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the combined invention of Fu and Mitra with the teaching of Vlahos as recited

above. The motivation for doing so would have been because the smoothing approach of Vlahos has provided good results in cleaning edge artifacts, among other things, as Vlahos indicated in Col. 4, lines 35-37.

Therefore, it would have been obvious to combine Vlahos with Fu and Mitra to obtain the invention of claim 2.

12. Regarding claim 3, note that it is drawn to the application of a matrix for the restoring operation (which is effected by sharpening); the application of the restoring matrix is identical to the application of the unsharpening matrix recited in claim 2 except for the specific matrix used. Since, as applicant admitted in lines 3-4 on page 16 of the 12/18/06 response, sharpening (i.e., restoring) is essentially the inverse of smoothing, it would have been obvious to one of ordinary skill in the art to use the inverse matrix of the unsharpening matrix for the sharpening operation (and therefore result in the restoration of the edges) and the motivation would have been to ensure that the image after sharpening will be restored to the original image (since the inverse of a function is expected to cancel the effect of that function). With this, claim 3 is similarly analyzed and rejected as per the analysis of claim 2.

13. Regarding claim 4, Vlahos further discloses

- obtaining density information x' of a pixel of said edge part of said edge unsharpened image according to a first equation $x'=(1-\lambda)x+\lambda C)$, wherein, λ is a positive constant, x is density information of said pixel of said original image, and C is surrounding density information representing density state of surrounding region of said pixel

[Col. 3, lines 49-56. See also the analysis of claim 2. Note that λ and C above correspond to 0.5 and (A+B)/2, where A and B are the two adjacent (to the left and right; or above and below) pixels of the pixel to be smoothed]

14. Claim 12 is similarly analyzed and rejected as per the analysis of claim 2 (also per the analysis of claim 8 re being a part of the apparatus).

15. Regarding claim 13, the combined invention of Fu, Mitra and Vlahos further discloses

- a pixel judgment part for judging whether a pixel exists in said edge part or in a near region of said edge part while scanning said original image pixel by pixel
  [Fu: Fig. 5, ref. 302 (edge detection). Note that per P. 25, lines 7-8 of the instance application, depending on the value of ε, the edge near region can be as small as just consisting of the edge part or as large as the entire image; therefore Fig. 302 performs the recited judging function because it determines whether a pixel is an edge pixel or not. See also the analysis of claim 8 regarding being a part of the apparatus]
- the matrix operation part for performing, when said pixel exists in said edge part or in said near region, matrix operation by using a block density information vector and unsharpening matrix, wherein said block density information vector is obtained by arranging density information of each pixel included in a block, said block includes said pixel and pixels in a surrounding region around said pixel, and order of said block density information vector corresponds to the number of pixels in said block, and wherein said unsharpening matrix includes coefficients used for edge unsharpening which operate on density information of each pixel in said block
  [Mitra: Col. 1, lines 45-48 (smoothing, or unsharpening, edges). Vlahos: Col. 3, lines 49-56 (using matrix operation for smoothing edges); see also the analysis of claim 2]

16. Claim 15 is similarly analyzed and rejected as per the analysis of claim 4 (also per the analysis of claim 8 re being a part of the apparatus).

17. Claims 20 and 21 are similarly analyzed and rejected as per the analysis of claim 3 (also per the analysis of claim 16 re being a part of the apparatus). [Specifically, regarding claim 20, as per the analysis of claim 16, the restoring matrix generation part and the matrix operation part can be implemented in software (i.e., computer programs)

residing in the memory of a computer and to be executed by its CPU). Regarding claim 21, note that the analysis of claim 3 teaches using the inverse of the unsharpening matrix as the restoring matrix.]

18. Regarding claim 22, Fu further discloses judging whether a pixel exists as an edge pixel or in a near region [Fig. 12, ref. 1202 and Col. 18, lines 62-64 (determining whether a pixel is on an edge or in a near region; for what constitutes a near region, see the analysis of claim 13)]. In addition, per the analysis of claim 3, the application of a matrix operation in the recited manner using a restoring matrix (the inverse of the unsharpening matrix) to obtain restored density information has been disclosed by the combined invention of Fu, Mitra and Vlahos. Also see the analysis of claim 16 re being a part of the apparatus.

19. Claim 24 is similarly analyzed as per the analyses of claims 3 and 22 (also per the analysis of claim 16 re being a part of the apparatus).

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20. Claims 9 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fu et al. (US 5,703,965) and Mitra et al. (US 5,426,673) as applied to claims 1, 8 and 16 above, and further in view of Acharya et al. (US 6,229,578).

21. Regarding claim 9, the combined invention of Fu and Mitra discloses all limitations of its parent, claim 8.

The combined invention of Fu and Mitra does not expressly disclose the following, which is disclosed by Acharya:

- said edge unsharpening part including a density information correction part for correcting density information of each pixel such that variation of density levels represented by density information of pixels which are arranged across said edge part in a near region of said edge part of said original image is lowered
[Fig. 1, refs. 140&160 (density information correction); Col. 5, lines 12-44. Note that in ref. 160 the variation of density levels of pixels in a near region of edge is lowered since the pixels are median-filtered. Note further that per P. 25, lines 7-8 of the instance application a near-region can be as large as the entire image; therefore a pixel is either an edge pixel or is in a near region]

The combined invention of Fu and Mitra is combinable with Acharya because they both have aspects that are from the same field of endeavor of image enhancement.

At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the combined invention of Fu and Mitra with the teaching of Acharya as recited above. The motivation for doing so would have been to remove noise without blurring the edge, as Acharya indicated in Col. 5, lines 40-44. .

Therefore, it would have been obvious to combine Acharya with Fu and Mitra to obtain the invention of claim 9.

22. Regarding claim 17, since it's purpose is to restore the edge part that has undergone the correction process recited in claim 9, it therefore would have been

obvious to reverse the correction process of claim 9 (i.e., to correct in such a manner that the density variation is increased, as opposed to decreased as in claim 9) and the motivation would have been to counter the effect of the correction of claim 9 in the coding process in order to restore the density level of the edge pixel such that it is close to its original value.

Allowable Subject Matter

23. Claims 28-30 are allowed.

24. Claims 5-7, 10, 11, 14, 18, 19, 23 and 25-27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

25. The following is a statement of reasons for the indication of allowable subject matter:

A. Regarding claim 5, and similarly claim 25, closest art of record Webb et al. (US 6,621,909) discloses a steepest-descent method to find a solution that minimizes a squared error [Col. 4, lines 32-67]; it also would have been obvious to one of ordinary skill in the art at the time of the invention to use the inverse of the unsharpen equation recited in claim 4 (which is taught by Vlahos) that can be expressed as $x = (x' - \lambda C)/ (1-$

λ) as the predetermined equation to perform the sharpening (i.e. restoring) operation. However, it would not have been obvious for one of ordinary skill in the art to be motivated to use the restoring equation according to a steepest descent method since it would have been obvious to apply the inverse of an operation directly (i.e., using x as the restored density value) in order to negate the effect of the operation (which has been previously applied) so as to restore the original data.

B. Regarding claim 10, and similarly claims 18 and 28, closest art of record Lee et al. (US 5,612,744) recites a mean-preserving smoothing operation [Fig. 2, ref. 26; Col. 4, lines 21-27] but provides no detail; Chen et al. (US 6,330,371) discloses using mean filtering [Col. 7, lines 19-23]; Acharya et al. (US 6,229,578) discloses smoothing edge and non-edge pixels using different methods (averaging of neighboring edge pixels and median filtering, respectively); Kaplan et al. (US 5,533,149) discloses smoothing pixels of interest near an edge [Figs. 1-4] using least square regression.

However, none of the references cited above, alone or in combination, disclose, teach or suggest density correction by calculating the mean of a predetermined region, comparing the value of each pixel in a second region (a near region, not necessarily identical to the predetermined region) to the mean, and adjusting the pixel value upward or downward depending on whether its value is lower or higher than the mean. [Note: In mean filtering the value of the center pixel of a window is replaced by the mean pixel

value of the window; no judging step as recited in claim 10 is needed; in addition, non-center pixels are not replaced by the mean value of the pixels in the window.]

C. Regarding claim 14, and similarly claims 23 and 30, while closest art of record Futamura (5,791,271) discloses generating distance map [Fig. 6, ref. S32; Figs. 7A, 7B, 8; Col. 6, lines 37-53] and based on the distance, determining whether a pixel is on or near an edge [Fig. 6, ref. S33; Col. 6, lines 54-55, 62-64], it would not have been obvious for one of ordinary skill in the art at the time of the invention be motivated to modify the combined invention of Fu, Mitra and Vlahos with such teachings. This is because in the analysis of claim 13 (the parent claim), either the entire image or only the edge part is considered a near region (per P. 25, lines 7-8 of the instance application, since the value of ε can be so large as to include the entire image or so small as to consist only of edge pixels) of the edge part; in either case there clearly is no need to carry out distance conversion.

Conclusion and Contact Information

26. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yubin Hung whose telephone number is (571) 272-7451. The examiner can normally be reached on 7:30 - 4:00. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew C. Bella

can be reached on (571) 272-7778. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

27. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Yubin Hung
Patent Examiner
Art Unit 2624

December 26, 2007